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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/634,212	08/05/2003	Karen Signorini	MICRON.249C1DV1	6861
20995	7590	06/24/2004	EXAMINER	
KNOBBE MARTENS OLSON & BEAR LLP			DOLAN, JENNIFER M	
2040 MAIN STREET			ART UNIT	
FOURTEENTH FLOOR			PAPER NUMBER	
IRVINE, CA 92614			2813	

DATE MAILED: 06/24/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/634,212

Applicant(s)

SIGNORINI, KAREN

Examiner

Jennifer M. Dolan

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-12 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-10 and 12 is/are rejected.
- 7) ☒ Claim(s) 11 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 05 August 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 8/5/03.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-6, and 8-10 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,650,958 to Gallagher et al.

Regarding claims 1 and 6, Gallagher discloses a magnetic memory device comprising: a pinned layer (18) magnetized in a first direction and patterned to a first width (4a-c); a sense layer (32) that can be selectively magnetized in the first direction or a second direction opposite to the first direction so as to change the net resistivity (column 2, line 40 – column 3, line 15), wherein the sense layer is patterned to a second width that is at least less than the first width (figures 4A-4c), where the magnetic field is varied by an external field to change the combined magnetic characteristic of the MR structure (column 2, line 40 – column 3, line 15).

Regarding claim 2, Gallagher discloses that the substrate comprises a conductor (12).

Regarding claim 3, Gallagher discloses that the pinned layer is formed above the substrate so as to overlie the conductor (figure 4A).

Regarding claim 4, Gallagher discloses that the device comprises a tunnel layer (20) formed over the pinned layer and between the pinned and sense layers (figure 4A).

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Regarding claim 5, Gallagher discloses that the sense layer overlies the tunnel layer (figure 4A).

Regarding claims 8 and 9, Gallagher discloses a spacer (40) positioned about the lateral edges of the sense layer and between the outer lateral edges of the sense and pinned layer (figure 4A).

Regarding claim 10, Gallagher discloses that the spacer is formed of a non-conducting material (column 5, lines 9-11).

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gallagher et al. in view of U.S. Patent No. 6,624,987 to Hayashi et al.

Gallagher discloses that the pinned layer is formed of NiFe (column 4, lines 55-60), and that the tunnel layer is formed of aluminum oxide (column 5, lines 1-2). Gallagher further teaches that the free layer can be made of Co, or a Co-Fe and Ni-Fe lamination.

Gallagher fails to specifically teach that the free layer is made of NiFeCo.

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Hayashi teaches a MTJ structure (figure 14) having a free layer (2), where the free layer is equivalently made of NiFe, CoFe, or NiFeCo (column 16, lines 65-67).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to specify that the free layer of Gallagher is made of NiFeCo, as suggested by Hayashi. The rationale is as follows: A person having ordinary skill in the art would have been motivated to use NiFeCo for the free layer, because Hayashi shows that any of NiFe, CoFe, or NiFeCo can be used interchangeably in a MTJ device (see Hayashi, column 16, lines 65-67). Since Gallagher suggests that an NiFe free layer has small switching fields, but also a lower signal, and that CoFe free layers have higher stability and higher signal, but also greater nonuniformity (see Gallagher, column 8, lines 4-15), it is well within the purview of a person having ordinary skill in the art to select and optimize a NiFeCo composition for the free layer, in order to achieve the desired switching fields, signal, stability, and uniformity.

5. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gallagher et al. in view of U.S. Patent No. 6,242,770 to Bronner et al.

Gallagher discloses a magnetic memory device comprising: a substrate (9), a bottom conductor (12); a pinned layer (18) formed above the substrate so as to overlie the conductor (figure 4A), wherein the pinned layer is magnetized to a first direction (column 4, lines 1-7) and has a first width (figure 4A); a tunnel layer (20) over the pinned layer and patterned to a first width (figure 4A); and a sense layer (32) above the tunnel layer, wherein the sense layer is selectively magnetized so as to change the net resistivity (column 2, line 40-column 3, line 15), wherein the sense layer is patterned to a second width smaller than the first width (figure 4A).

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Gallagher fails to specifically disclose that the substrate has an opening, and that the lower conductor is formed in the opening.

Bronner discloses an MRAM cell having a conductor disposed in an opening in the substrate, with the MTJ structure above the conductor (see figure 1).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to specify that the lower conductor of Gallagher is formed in an opening in the substrate, as suggested by Bronner. The rationale is as follows: A person having ordinary skill in the art would have been motivated to provide the lower conductor in an opening in the substrate, because doing so allows for easy integration with memory circuit components, such as diodes (Bronner, column 3, lines 25-40; figure 1), allows for greater memory density (Bronner, column 3, lines 1-25), and allows for the MTJ cell to be deposited on a planarized surface (see Bronner, column 4, lines 25-35; figure 1)

#### ***Allowable Subject Matter***

6. Claim 11 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

7. The following is a statement of reasons for the indication of allowable subject matter: The primary reason for allowability is the requirement that the spacer is formed of SiN, SiC or amorphous carbon. The prior art only teaches or suggests using silicon dioxide or aluminum oxide to form the spacer. It is the examiner's opinion that based upon the prior art, a person

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having ordinary skill in the art would have no motivation to use SiN, SiC, or a-carbon as a free layer sidewall spacer.

### ***Conclusion***

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent No. 6,555,889 to Hiramoto discloses an MRAM structure using pinned and free layers with different widths.

U.S. Patent No. 6,325,900 to Komuro et al. discloses both MRAMs and TMR sensors having pinned and free layers with different widths.

U.S. Patent No. 6,233,172 to Chen et al. discloses motivations for patterning a free layer with a smaller width than a pinned layer.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Dolan whose telephone number is (571) 272-1690.

The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jennifer M. Dolan  
Examiner  
Art Unit 2813

Jennifer M. Dolan  
Examiner  
Art Unit 2813

jmd

  
**ERIK J. KIELIN**  
**PRIMARY EXAMINER**